Seminar 2

Data Storage Paradigms, IV1351

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1 Introduction

Managing data and working with data is one of the most important challenges we are facing in the new era. Managing data and information plays a crucial role in different organisations' success rates. Another importance of managing data is its impact on customer satisfaction of the organisation and on how we manage the security of different projects. In addition, the way we manage data can have a direct impact on the efficiency of the project. In this report, a Logical and Physical model for the database of a music school called Soundgood is desgnied.

1.1 Soundgood music school overview

As seen in the previous seminar, Soundgood music school offers different types of music lessons for students to help them pick the journey they desire in the music world. In this music school, the lessons are given in groups and individually. The lessons are based on the different levels. There are also ensembles where different students from different lessons can gather together and play different instruments together. Additionally, the administrative staff have the authority to assign an instructor to a lesson. It should also be noted that each lesson should have an instructor. In this music school, students have the opportunity to borrow a maximum of two instruments. This is in case, the instrument desired to borrow is available.

1.2 Requirements

All the project descriptions explained on Canvas should be followed in the Logical and Physical model. To explain this in further detail, all the data that is related to students, instructors, payments, instruments, and the inventory should be stored. In contracts with the conceptual model, all the data types stored and details related to coding should be clearly stated. This will be explained more in the method and result part.

- All the requirements of Soundgood music school should be fulfilled in the Logical and Physical model. Thus, the designed model should have the capability to manage all the details regarding the enrollment of students and lesson bookings.
- Since a Logical and Physical model is required for this task, it should define what data to be stored and how the data is stored. This should include the use of primary and foreign keys, correct usage of cardinalities and relationships between tables.
- The Logical and Physical model should be made in UML or using IE notation. In this model, the IE notation is used. The Logical and Physical model contains all the relevant information described in the project description. It should be noted that all the detailed information should with their details should be stored.
- he report should include a relevant discussion that thoroughly elucidates the task. In addition, in order to achieve a higher grade a policy and price management entity, alongside ENUMs should be used.

This task is done with the collaboration of Daniel Ibrahimi and Esra Salman.

2 Literature Study

in order to get started with this project, chapters nine, fourteen and fifteen of the book "Fundamentals of Database Systems", were reviewed by the group. The first step of the understanding process is to understand that a Logical and Physical model is developed from the Conceptual Model. Furthermore, a Logical and Physical model is a model that explains what data is stored and how it is stored. On one hand, the purpose of the Logical model is to provide information on the representation of data and the relevant relationships between the various data. On the other hand, the Physical model's purpose is to handle the hows of the given data, realizing the Logical model in, in this case, PostgreSQL.

After being done with all the theoretical aspects of how the Logical and Physical model works, it is important to learn about the practical aspects on how to model and implement the model for the music school. As in this task, the two different models are merged into one model. In this part, the videos provided on Canvas are used in order to be able to design a Logical and Physical model using IE notation.

3 Method

This part will explain how the methodology of designing the logical and physical model works. Astah was used as the text editor in this task.

3.1 Designing the model

The first step is to read the project description on Canvas and see that everything on the conceptual model is correct. The next step is to go from the CM to the logical and physical model. After doing all this, one can start with the methodology. The methodology is divided into eleven steps with different iterations. The first iteration is to use the conceptual model to fill up the relevant tables. The second is to find all attributes with most one value. The third iteration is to fill the tables for higher cardinalities. Then column contraints were implemented, and after that the assignments of PK to the tables. After that, relations are drawn that are less than many to many. Finally, cardinalities are considered for all relations, then assignments of FK keys to the entities. All of the steps above are iterated until a satisfying result was attained.

Following that, the model undergoes evaluation for normalization, which involves arranging and structuring the data to minimize redundancy and dependency. In a Logical model, this involves establishing relationships between tables and minimizing data redundancy. On the other hand, the Physical model concentrates on optimizing performance and storage to enhance query performance.

In the end, all queries are written down in a document with consideration to the tables inheritance listing. So the inheriting table is written after the inheritor table, for instance, the person is above that student and instructor.

4 Result

In Figure 1, a visual representation illustrates the model, showcasing tables, cardinalities, relations, keys, and data types. Similar to the preceding model, the Logical and Physical Model integrates all prior tables, with a few additions. The PK, person id, is mirrored in both student and instructor tables as FK. Despite person-id being a SERIAL in the person table, it's represented as an INT in the other two tables, as the sequential order is inconsequential in the child entities.

Furthermore, the lesson and timeslot tables share the attribute lesson-id. In the inheriting timeslot table, this attribute functions as both a FK and a PK to prevent duplicates. For example, if a lesson with a specific lesson id is booked, it cannot be scheduled again for the same time. The policy table serves as a comprehensive category encompassing various requirements, including the number of instruments allowed for student rentals, rental dates, and policy descriptions related to instrument renting. Another aspect of the policy involves rental duration, with the school imposing a one year limit.

Regarding the policy table, a connection is established with another ENUM table, policy description ENUM, containing the description attribute. This allows for detailed descriptions associated with a description-id. Despite the use of ENUM, which restricts user choices when selecting options, it provides a constrained domain. Another instance of ENUM is evident in the lesson and lesson type ENUM entities, where users can choose a lesson type and its skill level from predetermined options rather than entering the skill level manually. Furthermore, the price management table, essential to lessons, produces various outcomes depending on the dates when students book lessons.

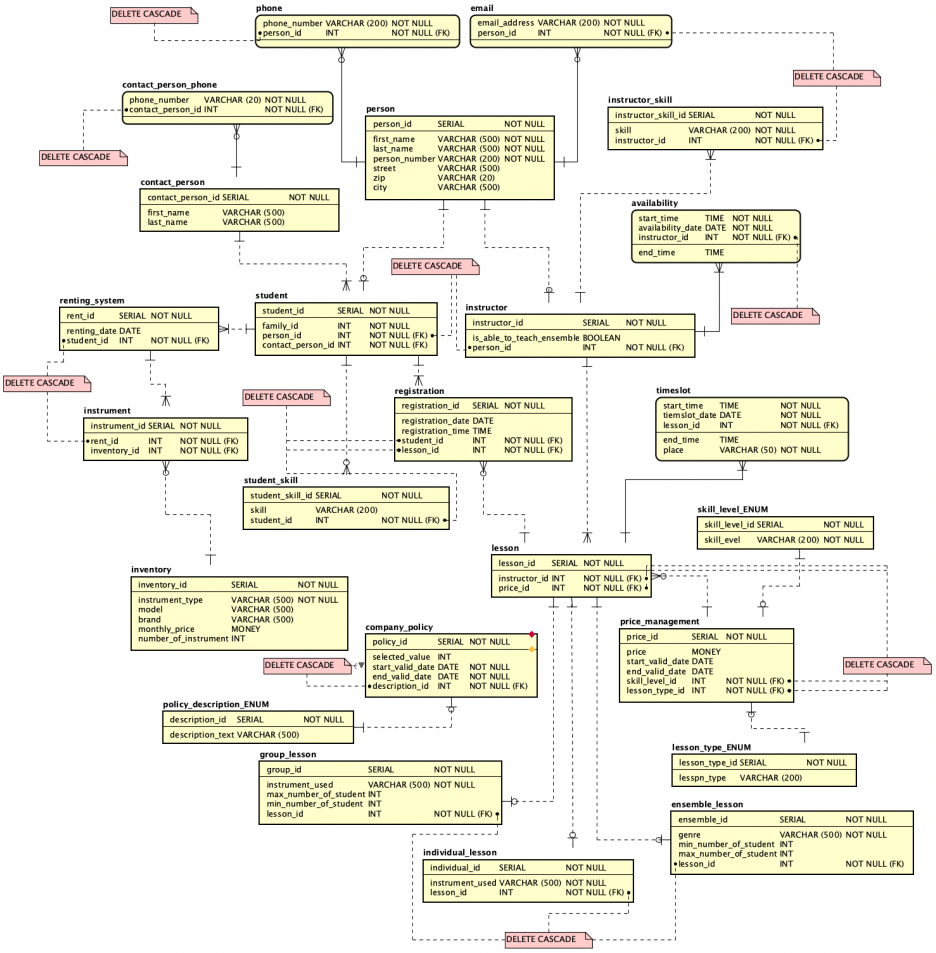

Figure 1: A model that represents the Logical and Physical aspects of modeling

5 discussion

As seen in Figure 1, the Logical and Physical model contains all the relevant information of the Soundgood music school. The number of entities is relevant to the needs of Soundgood music school. In addition, conventions are followed in all the names to make the model more coherent for the audience, alongside a correctly used crow notation, IE notation. All tables in this case are relevant since they cover the information provided in the description of the school. Even the ENUM tables are included, since they are required to be, in three spots.

In addition, there are columns for all the data to be stored and all constraints are specified, see figure 1. Besides, the PK and FK are all established after several iterations. For instance, the studentID as a PK in the student entity is relevant for its case, since it is connected to several other entities and described as FK as such. This information provides the user with the relevancy of renting information or lesson information.

All tasks, such as booking a lesson, renting an instrument, receiving discounts due to siblings, having limitations of renting periods, choosing different lesson types, and providing information, are all possible tasks to perform in through the given model. Moreover, ENUMS are implemented throughout the model for all cases when text constants are used. This is found in lesson type and skill level where the student could choose between three different levels. Instead of typing the level the user is instead provided the given options to choose from.

Furthermore, there are a few more points to be made regarding the higher points requirements. One of which is regarding the policy in the school for various tasks to be made. An example is when a student wants to burrow an instrument and has a limitation of two burrowed instruments, for this information to be provided to the user,it has to be derived from the renting system and be concluded with the the policy entity. Another instance is if the burrowed instrument has a limitation in burrowed time, which the school has a policy for, that of the year, mentioned above.

Finally, an important note is to be made regarding the pricing of the database in the school. Since there is a requirement for dynamic pricing in the school, it is provided in the price management with an end date and start date for cases when a student's pricing might change due to the school's differing pricing during a year or season. Also, this kind of data is saved and could be revisited to compare the previous pricing and the current one, both to motivate the customer, in this case the student, but also for legal cases.

6 Link to Github

https://github.com/ermia1230/IV1351.git